

CLAIMS

1. A method of cutting a plastic functional film, in particular a protective film, in the state applied to a hard substrate, such as a glass plate, characterized in that said cut is made with the aid of an ultrasound cutting device, whose characteristics and parameters have been selected so that the cut is made only in the thickness of the functional film while leaving the underlying substrate intact.
2. The method as claimed in claim 1, characterized in that use is made of an ultrasound cutting device having a head intended to penetrate the functional film, which has an end portion in the general shape of the point with an angle at the apex at least equal to 30°.
3. The method as claimed in claim 2, characterized in that a head is chosen that has an end portion in the general shape of the point with an angle at the apex of the order of 70°.
4. The method as claimed in one of claims 2 and 3, characterized in that the end of the point is rounded, semispherical or has the shape of a point with a larger angle than the foregoing, having an angle generally greater than 110°, being particularly of the order of 130°.
5. The method as claimed in one of claims 2 to 4, characterized in that a head is chosen having the general shape of a blade whose end is rounded in the mid-plane of the blade and has said end portion pointed along the plane perpendicular to the mid-plane of the blade.

6. The method as claimed in one of claims 2 to 4, characterized in that a head is chosen having the shape of a cone whose angle at the apex is at least equal to 30° , being particularly of the order of 70° , the end of said cone being able to be rounded, semispherical or to have the shape of a cone of a larger angle than the foregoing, having an angle generally greater than 110° , being particularly of the order of 130° .
7. The method as claimed in one of claims 1 to 6, characterized in that a head is chosen made of a material chosen from steel, titanium and aluminum, said material having, where appropriate, received at least a surface treatment, such as a polish or the formation of a particular surface state and/or at least one layer deposition.
8. The method as claimed in one of claims 1 to 7, characterized in that use is made of an ultrasound system with a power less than 1000 Watts, particularly less than 500 Watts, preferably 100 - 300 Watts, with an amplitude of vertical movement of the head of 2 to 40 μm .
9. The method as claimed in one of claims 1 to 8, characterized in that an ultrasound system is used with a vibration frequency of 20 000 to 70 000 Hz.
10. The method as claimed in one of claims 1 to 9, characterized in that the cut is made with a pressure of the head on the substrate coated with the functional film from a value corresponding to the tool placed on said coated substrate up to a value of 2 bar, particularly from 0.5 to 2 bar.
11. The method as claimed in one of claims 1 to 8, characterized in that the cut is made with a movement of the substrate coated with the

functional film relative to the head of 120 meters/min. at the most, particularly of 30 to 100 meters/min.

- 5 12. The method as claimed in one of claims 1 to 9, characterized in that the substrate consists of a flat or arched plate of monolithic or laminated glass, or of a hard plastic such as polycarbonate, said plates having received, where appropriate, at
10 least one treatment on at least one face, for example by the application of a functional layer, such as a dirt-repellent layer, a rain-repellent layer, an antireflection layer, an antiscratch layer, a sun-protection layer.
- 15 13. The method as claimed in one of claims 1 to 12, characterized in that the functional film is made of a plastic chosen from the polyolefins such as the low density, medium density and high density
20 polyethylenes and their blends, and polypropylene, poly(vinylchloride)s and poly(ethylene terephthalate), where necessary coated with an acrylic adhesive layer, or is an acrylic film, said film being able to be formed of several
25 layers each of which is formed of a plastic chosen from those that have just been indicated or is an acrylic layer.
- 30 14. The method as claimed in one of claims 1 to 13, characterized in that the functional film, being able, at least on a portion of the substrate, to be applied in double thickness, has an overall thickness of between 20 and 200 μm , particularly between 80 and 160 μm .
- 35 15. The method as claimed in one of claims 1 to 14, in which the substrate consists of a glazing unit, such as a self-cleaning glazing unit, coated for this purpose with a metal oxide layer such as

TiO₂, characterized in that a cut is made which leaves the film on the main portion of the glass pane corresponding to the see-through portion, and which makes it possible to remove the film from the regions of the borders of the glazing unit, said borders being intended to be inserted into the rebates of the frames and to be hidden from view by cover strips.

16. The method as claimed in one of claims 1 to 14, in which the substrate consists of a glass plate, characterized in that a cut is made that makes it possible to remove the film from any desired location to carry out therein a sandblasting process, or fit an accessory therein, or carry out a bonding of glazing bars on the glass to give a "small pane" effect or look, or to make a hole in the glass sheet in order to attach a through-mounting ball joint, the film being able to be cut along a perimeter greater than that of the hole, the edges of the hole cleared by the cutting of the film being able to take a seal, where necessary after an acid etching treatment of the glass thus cleared around the hole.

17. A method for protecting at least one face of a substrate of the plate type during its transportation from the production site to a site of use or installation and during installation handling operations, at least one region of the surface of the substrate needing to be uncovered during the installation handling operations, the protection having to be maintained at least temporarily on the remaining region or regions, characterized in that a plastic protective film is deposited on the whole of each face to be protected of the substrate for its transportation, and that, to make it possible to remove the film in the region or regions that have to be

uncovered, an ultrasound cut is made of said protective film along the contour of said region or said regions.

- 5 18. A substrate such as a glass plate intended to form
a glazing unit, a motor vehicle window, a
windshield, coated with a functional film, in
particular a protective film, particularly
10 peelable, said film comprising an ultrasound cut
that has been made through its thickness without
the underlying substrate being damaged, whether or
not the cut parts have been removed.
- 15 19. An apparatus for carrying out the method of
cutting by ultrasound as defined in one of claims
1 to 17, said apparatus being automatic,
semiautomatic or consisting of a portable tool,
and comprising an ultrasound cutting device, as
defined in one of claims 1 to 9.
- 20 20. The apparatus as claimed in claim 19,
characterized in that it consists of a glass
cutting table onto which an ultrasound film
cutting device has been fitted, said ultrasound
25 cutting device being suitable for moving in a
single direction or in the two directions X,Y.